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Binge Eating Disorder and Medical Comorbidities in Bariatric Surgery Candidates

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Abstract

Objective—To determine whether binge eating disorder (BED) status is associated with medical comorbidities in obese adults scheduled for bariatric surgery.

Method—The study utilized Longitudinal Assessment of Bariatric Surgery-2 data obtained from 6 clinical centers around the United States. This is a well-phenotyped cohort of individuals who were evaluated within 30 days prior to their scheduled surgery using standardized protocols. In the cohort, 350 participants were classified as having BED and 1875 as not having BED (non-BED). Multivariable logistic regression was used to determine whether BED status was independently related to medical comorbidities. As an exploratory analysis, significance was based on nominal *P*-values ($p<.05$). Holm-adjusted *P*-values were also reported.

Results—After adjusting for age, sex, education and body mass index, BED status was independently associated with 4 of 15 comorbidities (i.e., impaired glucose levels (odds ratio [OR]=1.45 (95%CI: 1.12–1.87), high triglycerides (OR=1.28 (95%CI: 1.002–1.63) and urinary incontinence (OR=1.30 (95%CI: 1.02,1.66) all being more common among the BED sample, and severe walking limitations being less common in the BED sample (OR=0.53 (95%CI: 0.29–0.96)). With further adjustment for psychiatric/emotional health indicators, BED status was independently associated with 3 comorbidities (impaired glucose levels (OR=1.36 (95%CI: 1.04–1.79), cardiovascular disease (OR=0.50 (95%CI: 0.30–0.86) and severe walking limitations (OR=0.38 (95%CI: 0.19–0.77)). However, Holm's adjusted *P*-values for all variables were greater than .05.

Discussion—The results suggest the possibility of a contribution of BED to risk of specific medical comorbidities in severely obese adults.

Keywords

binge eating disorder; metabolic syndrome; medical comorbidities

Introduction

Binge eating disorder (BED) was included in the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition[1] as a provisional eating disorder diagnosis for further study. This inclusion resulted in the development of a large research literature on this disorder, and recently BED was added as a psychiatric diagnosis in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition[2,3] with only minor modifications from the originally proposed criteria[4].

Data from the World Health Organization Mental Health Survey Study[5] including community surveys involving 24,124 adult respondents, indicate that the lifetime prevalence of BED averages 1.4% (range 0.8% to 1.9%) across mostly upper-middle and high-income countries. These data show that lifetime risk of BED is elevated among women, and the disorder appears to be more common in recent cohorts. BED is common among individuals with obesity, with prevalence rates commonly in the range of 3.3 to 5.5%[6]. A recent review of studies investigating BED and BE among bariatric surgery patients found that prevalence of BED/BE ranged from 14–56% in 8 studies reporting pre-operative status[7].

Several research groups have been interested in examining the relationship between BED and the medical complications commonly seen in obese individuals[8–11]. Of particular interest, Hudson et al.[11] examined whether BED was associated with the development of hypertension, dyslipidemia and type 2 diabetes. One hundred and thirty-four individuals with BED and an equal number of controls with no history of an eating disorder were matched for age, sex and baseline body mass index (BMI), and interviewed at 2.5 and 5 year follow-up. After adjusting for age, sex, baseline BMI, and interval BMI changes, having BED increased risk of developing dyslipidemia (hazard ratios (95% confidence interval [CI]): 2.2 (1.2–4.2)). There were not statistically significant differences between those with and without BED with respect to developing hypertension or type 2 diabetes (hazard ratios (95% CIs): 1.5 (0.8–2.9) and 1.6 (0.8–3.9), respectively). However, those with a baseline history of BED had higher risk of developing any of these conditions (1.7 (1.1–2.6)) and 2 or more of these conditions (2.4 (1.1–5.7)). The strengths of this study include the prospective design and well-chosen and carefully characterized control group. Limitations include the sample size, the modest number of outcomes assessed, and the use of patient self-report as the method of ascertaining medical complications.

Utilizing data from the Longitudinal Assessment of Bariatric Surgery-2 (LABS-2) study[11,12], the current effort investigates whether baseline presence or absence of BED independent of BMI is related to hypertension, dyslipidemia, type 2 diabetes and several other comorbidities of obesity, using established definitions and standard instruments to determine outcomes. The comorbidities represent the most common medical complications associated with elevated body weight.

METHODS

The Longitudinal Assessment of Bariatric Surgery (LABS) Consortium was established in 2003 to support clinical, epidemiologic, and behavioral research in bariatric surgery and

address deficiencies in the existing bariatric surgery research literature[12,13]. LABS-2, a part of the LABS project, includes 6 clinical centers involving 10 hospitals in the United States, is a prospective longitudinal study designed to examine the longer-term safety and efficacy of bariatric surgery in a well-phenotyped cohort undergoing bariatric surgery[13]. At the close of enrollment, 2,458 participants met inclusion criteria, attended a pre-operative visit and underwent a bariatric surgery procedure by one of 33 LABS certified surgeons[13].

Within 30 days before their scheduled surgery, participants attended a research visit where baseline data were obtained by trained investigators using standardized protocols. Participants also completed various self-report inventories, including a self-report form designed to assess the presence or absence of BED using questions adapted from the Questionnaire for Eating and Weight Patterns-Revised (QEWP-R)[15] that allowed for diagnoses approximating DSM 5 BED criteria to be inferred from self-report. The exception is that 6 months rather than 3 months was required, as the form was developed prior to DSM 5. The QEWP-R has been shown to be have reasonable agreement with interview-based measures for the diagnosis of BED; however, it is generally more sensitive and less specific than structured interviews such as the Eating Disorders Examination[16]. Participants were not interviewed regarding BED status and all data were collected pre-surgery.

Weight was obtained using a Tanita scale (model TBF-310H01A) and height was determined using a wall-mounted stadiometer with the participant in light clothing and stocking feet. Body mass index (BMI) was calculated as kg/m^2. Waist circumference was measured while the participant was standing using the Gulick II Tape Measure (model 67020). The measurement was taken around the abdomen horizontally at the midpoint between the highest point of the iliac crest (hip bone) and lowest part of the costal margin (ribs). A single measurement of systolic and diastolic blood pressure (SBP and DBP, respectively) was obtained using a Welch Allyn Spot Vital Signs monitor 4200B. Laboratory assays were performed on fasting samples (at least 8 hours) by the Northwest Lipid Metabolism and Diabetes Research Laboratories (Seattle, WA).

Details concerning the definitions employed for the medical comorbidities and the laboratory and others measurement parameters utilized for assessment are provided in Appendix 1 on-line.

Data Analysis

Analyses were conducted using SAS (version 9.3; SAS Institute Inc., Cary, N.C.). Frequencies and percentages were reported for categorical data. Medians, 25^{th} and 75^{th} percentiles are reported for continuous data that are not normally distributed. Pearson's chi-square test of association for categorical variables and Wilcoxon rank-sum test for continuous variables were used to assess statistical significance of differences among: 1) those included vs. excluded from the analysis, and 2) those with vs. without BED.

Multivariable logistic regression was used to determine whether BED status was independently related to having comorbidities and individual components of the metabolic syndrome. Because all participants met the central obesity criterion for the metabolic syndrome, multivariable linear regression was used to determine whether BED status was

independently related to waist circumference. The first set of models controlled for age, sex, education, and BMI as these demographics and health indicators are potential confounders (i.e., related to risk of BED, as well as comorbidities[5]. The second set of models also controlled for psychiatric/emotional health factors found to be related to BED status in our prior report[16]: taking medication for psychiatric or emotional problems, and having greater depressive symptoms (measured using the Beck Depression Inventory[17]), symptoms of alcohol use disorder (measured using the Alcohol Use Disorder Identification Test[18]), and lower self-esteem (measured using the Interpersonal Support Evaluation List[19]). The analysis was repeated excluding participants who did not have BED but endorsed criteria A and D in the DSM 5 BED criteria set (the presence of binge eating episodes accompanied by a sense of loss of control) indicating "subsyndromal" BED.

Since this analysis was seen as primarily exploratory, the primary analysis did not control for multiple comparisons. Adjusted odd ratios (OR) and 95% confidence intervals (CI) and nominal 2-sided *P*-values are reported; *P*-values less than .05 were considered to be statistically significant. Holm-adjusted *P*-values (for fifteen dependent variables) were also calculated[20].

RESULTS

The current report excludes 192 of the 2,458 LABS-2 participants who did not complete the eating behavior questions at the baseline assessment, as well as 41 who did not complete all questions required to determine BED status, resulting in an analysis sample of 2,225. Those who were excluded were more likely than those included to be black (19.4% vs. 9.7%; p<. 01); otherwise, they did not differ significantly with respect to health behaviors or health indicators reported in Tables 1 and 2.

Median age was 46 years (range 18–78); 78.6% were female; 86.9% were white; median BMI was 45.9 kg/m^2 (range = 33.0 – 94.3 kg/m^2). Overall, 350 (15.4%) participants met DSM 5 criteria for BED by self-report, and 1,875 did not. Two hundred-two (10.8%) of the non-BED sample endorsed criteria A and D in the DSM 5 BED criteria set, indicating "subsyndromal" BED. Thus, in total, 552 (24.8% of the analysis sample of 2,225) met criteria for BED or "subsyndromal" BED by self-report. Socio-demographic and select health characteristics of those with and without BED are shown in Table 1.

The prevalence of the various medical comorbidities and components of the metabolic syndrome by BED status are shown in Table 2. Initial analysis adjusting for age, sex, education and BMI included "subsyndromal" BED subjects who endorsed binge eating and loss of control but not the entire set of diagnostic criteria (Table 3) suggested independent positive associations between BED status and high triglycerides (p=0.048), impaired glucose (p<.005), and urinary incontinence (p=.04), and a negative association between BED status and severe walking limitations (p=.04). After additional adjustment for psychiatric/ emotional health indicators, relationships between BED and high triglycerides and urinary incontinence lost significance, whereas BED continued to be significantly positively related to impaired glucose (p=.03) and negatively related to severe walking limitation (p=.01). Additionally, BED was significantly negatively associated with CVD (p=0.01). Holm's

adjusted *P*-values were all greater than .05. BED status was not significantly related to waist circumference independent of sex, age and BMI, with (p=.75) or without (p=.61) consideration of psychiatric/emotional health indicators.

Analysis excluding the "subsyndromal" BED sample (those reporting symptoms of binge eating and a sense of loss of control but not the symptoms of full syndromal BED) did not differ substantively from the main analysis and are not shown.

DISCUSSION

These results support the possibility that BED is a risk factor for medical comorbidities, including components of the metabolic syndrome, in severely obese bariatric surgery candidates. Specifically, there were statistically significant higher odds of impaired fasting glucose levels, high triglycerides and urinary incontinence, but lower odds of severe walking limitations, with control for demographics and BMI. Because we previously found that those with BED were more likely to report indications of poor psychiatric/emotional health (i.e., medication for psychiatric or emotional problems, depressive symptoms, symptoms of alcohol use disorder and low self-esteem)[17] and because psychiatric/emotional health has been identified as an independent risk factor for medical comorbidities,[22,23] analysis was repeated controlling for these potential confounders. Associations between impaired fasting glucose levels and severe walking limitations with BED remained statistically significant. However, associations with triglycerides and urinary incontinence were no longer significant, while the association with CVD remained. The finding regarding glucose levels is particularly interesting given the results from the Hudson et al. study discussed earlier (hazard ratios (95% CIs): 1.5 (0.8–2.9 for type 2 diabetes). It is difficult to hypothesize why BED may independently decrease the odds of walking limitations and CVD. An important consideration is that just as poor psychiatric/emotional health can be a risk factor for medical comorbidities, medical comorbidities can be a risk factor for poor psychiatric/emotional health.[23] Thus, it is not entirely clear whether controlling for psychiatric/emotional health clarifies the relationship between BED and medical comorbidities. Though reporting statistical significance based on nominal p-values above, the large number of comparisons performed increases the experiment-wise error rates; hence, the possibility of incorrectly identifying a significant association. Therefore, in this exploratory study for which the power to detect meaningful associations after adjusting for multiple comparisons is limited, the reader is cautioned to consider the decision to base significance on unadjusted *P*-values as grounded on the desire to identify possible associations. *P*-values adjusted for multiple comparisons are also reported; none of the associations reported are significant following the adjustment. Future work should clarify whether the relationships identified in this study exist or were found by chance. These findings clearly should be followed-up in other samples, as well as in this sample over time.

Relative to other available literature, of particular interest Taylor et al.[25] demonstrated that BE impacted metabolic parameters adversely even if total calorie and macronutrient intake were appropriate for BMI in a sample of healthy lean women in a feeding laboratory paradigm. Johnson et al.[8] reported elevated rates of diabetes in BED vs. non-BED patients among primary care and obstetrics and gynecology clinic patients, although it was unclear

whether or not the analysis controlled for BMI. Guerdjikova et al.[9] reported high rates of the occurrence of metabolic syndrome among women with BED all of whom were obese. Roehrig et al.[10] reported a comparison of BED patients with or without metabolic syndrome, finding that they did not differ as to frequency of binge eating or measures of severity of eating disorders psychopathology. Although of interest, these papers do not directly address the central question that is the focus of this report. However, of note, a report by Tanofsky-Kraff and colleagues[26] found that the presence of self-reported binge eating in children was associated with higher risk for the development of the metabolic syndrome, and a report by Field and colleagues[27] found that independent of BMI status, girls who frequently engaged in binge eating were at higher risk of developing diabetes.

Strengths of the current effort are the rigorous assessment of several comorbidities which were based on standardized definitions and objective testing where possible (although the assessments of others remained subjective, based on self-report; e.g. asthma), as well as the large sample size. Relative to limitations, it must be remembered that the diagnosis of BED was made by self-report rather than interview, which may have resulted in misclassification. Additionally, as opposed to the Hudson et al.[11] study, the data reported here are cross-sectional rather than prospective. Although we strove to measure independent relationships between BED and medical comorbidities, it is possible that not all confounders were accounted for or measured. Additionally, the pattern of onset of these comorbid disorders could not be assessed. Thus, we could not determine whether historically patients with BED developed the medical comorbidities they manifested at an earlier age. We also did not determine whether those with BED developed a more severe form of the comorbidity. Another consideration is that the severity of the obesity in this sample and the high prevalence of medical comorbidity may have masked the effects of BED that might be demonstrable in a sample with a wider range of BMIs. Another limitation is that the results may not generalize to minority populations, given their low participation rate.

Further analysis will need to examine the influence of pre-surgical and/or post-surgical problems with BED and binge eating on the course of these medical comorbidities over time, including their possible resolution, recurrence, persistence, or de novo onset, as the cohort continues to be followed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1

Sociodemographics and Select Health Characteristics in Severely Obese Adults with Binge Eating Disorder (BED) vs. without BED

	Non-BED (n=1875)		BED (n=350)		p value
Male	411	(21.9%)	69	(19.7%)	0.36
Age, years, median (25th, 75th percentile)	45	(37–54)	47	(37–55)	0.22
Age group					0.27
< 30	154	(8.2%)	29	(8.3%)	
30–39	469	(25.0%)	85	(24.3%)	
40–49	533	(28.4%)	82	(23.4%)	
50–59	503	(26.8%)	107	(30.6%)	
60+	216	(11.5%)	47	(13.4%)	
Race					0.07
White	1604	(86.1%)	314	(90.8%)	
Black	190	(10.2%)	24	(6.9%)	
Other	68	(3.7%)	8	(2.3%)	
Hispanic	95	(5.1%)	13	(3.7%)	0.29
Education					<0.01
≤ High School	440	(23.6%)	66	(19.0%)	
Some College	771	(41.3%)	126	(36.2%)	
≥ College Degree	654	(35.1%)	156	(44.8%)	
BMI, kg/m^2, median (25th, 75th percentile)	45.9	(41.9–51.4)	45.6	(41.3–51.6)	0.44
Smoking	235	(12.5%)	51	(14.6%)	0.29
Symptoms of Alcohol Use Disorder	125	(6.7%)	43	(12.4%)	<0.001

TABLE 2

Prevalence of Medical Comorbidities and Components of the Metabolic Syndrome among Severely Obese Adults with vs. without BED Using an Unadjusted Significance Level[a]

	Non-BED (n=1875)		BED (n=350)		p value
	n(%)		n(%)		
Metabolic Syndrome					0.21
No	369	21.0	58	18.0	
Yes	1390	79.0	265	82.0	
Blood pressure, ≥130/≥85 mg/dL					0.61
No	403	21.7	71	20.5	
Yes	1455	78.3	276	79.5	
HDL, <40 mg/dL men, <50 mg/dL women					0.88
No	525	30.3	97	30.7	
Yes	1209	69.7	219	69.3	
Triglycerides, ≥150 mg/dL					0.051
No	1031	61.2	176	55.4	
Yes	654	38.8	142	44.7	
Impaired Glucose ≥100 mg/dL					<.01
No	835	46.7	127	38.5	
Yes	952	53.3	203	61.5	
Diabetes					0.72
No	1206	67.0	221	66.0	
Yes	595	33.0	114	34.0	
Cardiovascular Disease					0.12
No	1698	91.1	324	93.6	
Yes	166	8.9	22	6.4	
Hyperlipidemia					0.07
No	997	64.2	164	58.6	
Yes	556	35.8	116	41.4	
PCOS (women only)					0.19
No	1247	86.8	234	83.9	

	Non-BED (n=1875)		BED (n=350)		p value
	n(%)		n(%)		
Yes	189	13.2	45	16.1	
Obstructive Sleep Apnea					0.39
No	890	47.5	157	45.0	
Yes	984	52.5	192	55.0	
Asthma					0.82
No	1382	74.3	262	75.9	
Yes	478	25.7	83	24.1	
Abnormal Kidney Function					0.35
No	1659	91.8	304	90.2	
Yes	149	8.2	33	9.8	
Urinary Incontinence					0.02
No	1075	58.1	177	51.2	
Yes	774	41.9	169	48.8	
Venous Edema					0.54
No	1751	93.4	323	92.6	
Yes	123	6.6	26	7.4	
Severe Walking Limitations					0.051
No	1609	92.7	309	95.7	
Yes	127	7.3	14	4.3	

BED=Binge eating disorder

HDL= high-density lipoprotein cholesterol

PCOS=Polycystic Ovary Syndrome

[a]Numbers of missing values not included

TABLE 3

Adjusted Odds of Medical Comorbidities and Components of the Metabolic Syndrome associated with Binge Eating Disorder.

	Controlling for sex, age, education and body mass index				Also controlling for psychiatric variables[a]			
	AOR	**95% CI**	**P value[b]**	**Adjusted P value[c]**	**AOR**	**95% CI**	**P value[b]**	**Adjusted P value[c]**
Metabolic Syndrome	1.24	(0.90,1.70)	0.18	1.0	1.18	(0.84,1.65)	0.33	1.00
Hypertension	1.10	(0.81,1.48)	0.56	1.0	1.19	(0.86,1.64)	0.29	1.00
Low HDL	1.00	(0.77,1.30)	0.99	1.0	1.00	(0.76,1.33)	0.98	1.00
High Triglycerides	1.28	(1.002,1.63)	0.048	0.66	1.03	(0.79,1.34)	0.82	1.00
Impaired Glucose	1.45	(1.12,1.87)	<0.005	0.10	1.36	(1.04,1.79)	0.03	0.34
Diabetes	1.00	(0.77,1.29)	0.98	1.0	0.96	(0.73,1.27)	0.78	1.00
Cardiovascular Disease	0.62	(0.38,1.02)	0.06	0.77	0.50	(0.30,0.86)	0.01	0.18
Hyperlipidemia	1.15	(0.87,1.52)	0.31	1.0	1.11	(0.83,1.50)	0.48	1.00
PCOS (women only)	1.25	(0.87,1.81)	0.23	1.0	1.25	(0.85,1.83)	0.26	1.00
Obstructive Sleep Apnea	1.18	(0.92,1.51)	0.19	1.0	1.11	(0.85,1.45)	0.43	1.00
Asthma	0.91	(0.70,1.20)	0.51	1.0	0.81	(0.60,1.08)	0.15	1.00
Abnormal Kidney Function	1.22	(0.80,1.86)	0.36	1.0	1.11	(0.70,1.74)	0.66	1.00
Urinary Incontinence	1.30	(1.02,1.66)	0.04	0.52	1.07	(0.82,1.39)	0.63	1.00
Venous Edema	1.22	(0.76,1.94)	0.41	1.0	1.02	(0.60,1.73)	0.59	1.00
Severe Walking Limitation	0.53	(0.29,0.96)	0.04	0.42	0.38	(0.19,0.77)	0.01	0.11

AOR=Adjusted Odds Ratio

HDL= high-density lipoprotein cholesterol

PCOS=Polycystic Ovary Syndrome

[a]Model controlled for age, sex and body mass index, as well as taking medication for psychiatric or emotional problems, depressive symptoms, symptoms of alcohol use disorder and self-esteem.

[b]Nominal *P*-values.

[c]Holm-adjusted *P*-values.